

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
PurpleAir PA-II

Pollutants:
PM₁, PM_{2.5}, PM₁₀

Measurement Range:
0 - 500 µg/m³

Type: Optical



Additional Information

Field evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/field>

Lab evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

AQ-SPEC website:

<http://www.aqmd.gov/aq-spec>

Evaluation Summary

- Overall, the three PurpleAir PA-II sensors showed moderate to good accuracy, compared to the reference instrument for PM₁, PM_{2.5}, and PM₁₀, for a concentration range between 0 to 250 µg/m³.
- The three PA-II sensors exhibited high precision for most of the tested T/RH combinations.
- PA-II sensors showed low intra-model variability as well as good sensor a and b correlation in each node.
- PA-II sensors had good data recovery (95%).
- For PM₁ and PM_{2.5}, the PA-II sensors had high correlation with the reference instrument from both the field (PM_{1.0} R² > 0.96, PM_{2.5} R² > 0.93) and laboratory studies (PM₁ R² > 0.99, PM_{2.5} R² > 0.99). For PM₁₀, the PA-II sensors did not always follow the concentration change recorded by FEM instrument in the field (PM₁₀ R² > 0.66), however in the laboratory, the PA-II sensors followed the concentration ramping (increasing) change, reporting (PM₁₀ R² > 0.95).

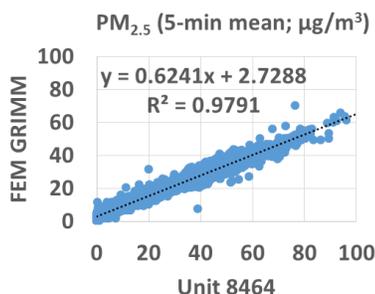
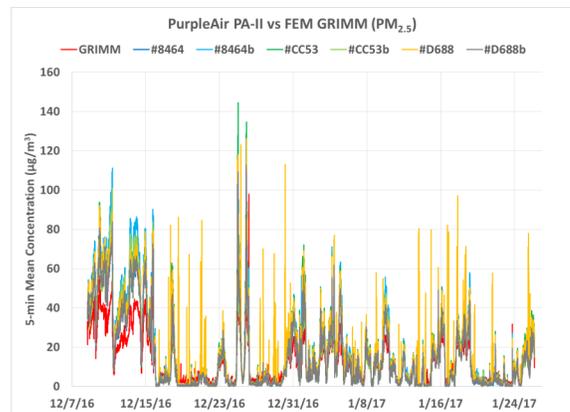
Field Evaluation Highlights

- Deployment period 12/18/2016- 01/26/2017: the three PA-II nodes correlated well the PM₁, PM_{2.5} concentration change as monitored by GRIMM and BAM. PA-II nodes did not always follow the PM₁₀ concentration change.
- The units showed 95-99% data recovery as well as low intra-model variability.

PM_{1.0} R² ~ 0.96 to 0.98

PM_{2.5} R² ~ 0.93 to 0.97

PM₁₀ R² ~ 0.66 to 0.70



Coefficient of Determination (R²) quantifies how the three sensors followed the PM concentration change by GRIMM.

An R² approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

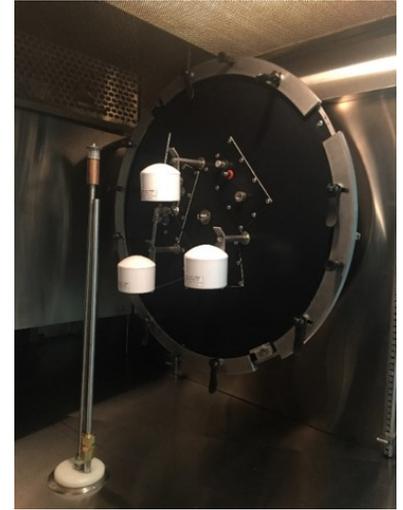
Laboratory Evaluation Highlights

Accuracy

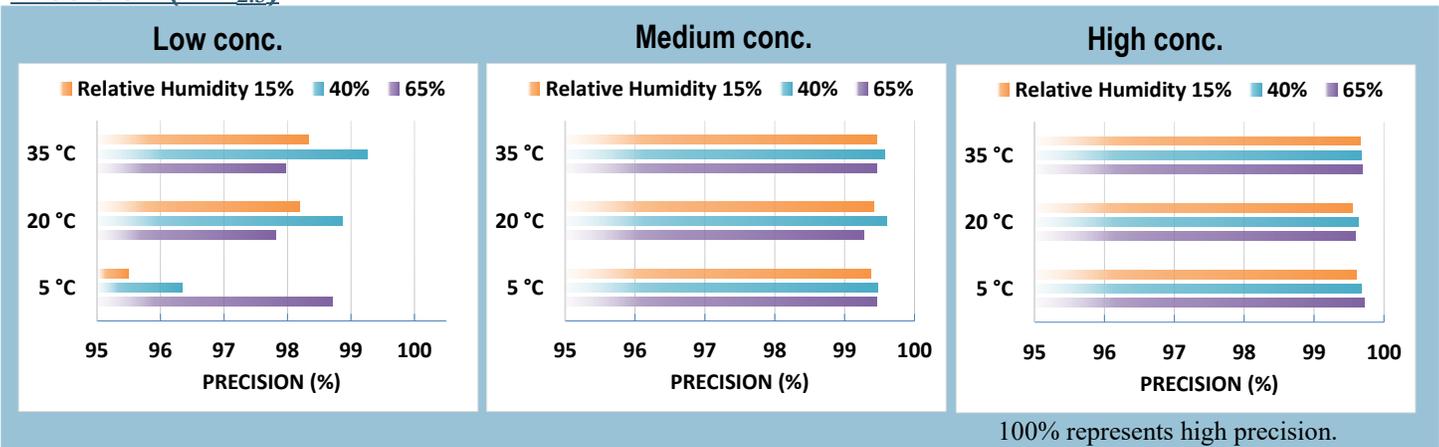
$$A (\%) = 100 - \frac{|\bar{X} - \bar{R}|}{R} * 100$$

Steady State (#)	Sensor mean ($\mu\text{g}/\text{m}^3$)	GRIMM ($\mu\text{g}/\text{m}^3$)	Accuracy (%)
1	19.7	13.5	54.3
2	44.3	35.7	75.7
3	80.8	84.1	96.1
4	134.7	155.1	86.8
5	186.3	233.5	79.8

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

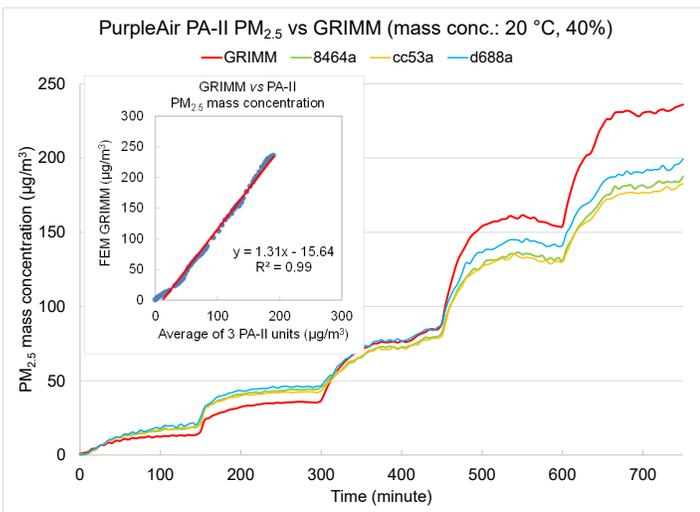


Precision (PM_{2.5})



Sensor's ability of generating precise measurements of PM concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5

Coefficient of Determination



The three PA-II sensors showed excellent correlation with the corresponding FEM PM_{2.5} data ($R^2 = 0.99$) at 20 °C and 40% RH.

For conc. ramping experiments of PM₁ and PM₁₀, please see full length lab reports.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the PA-II sensors' precision. At the set-points of RH changes, PA-II reported spiked changes in concentrations.

Observed Interferents

N/A



All documents, reports, data, and other information provided in this document are for informational use only. Mention of trade names or commercial products does not constitute endorsement or recommendation. The South Coast AQMD's AQ-SPEC program, as a government agency, recommends the interested parties to make purchase decisions based on their application.